

Claims:

1. An expandable seal for sealing at least part of a wall of a well borehole, the expandable seal comprising:

an expandable tubular support member; and

an inflatable seal element mounted externally of the expandable tubular support member for inflation radially outwardly into sealing engagement with at least part of the wall of the well borehole.

2. A seal as claimed in claim 1, wherein the expandable seal is adapted for sealing at least part of a wall of an unlined well borehole.

3. A seal as claimed in claim 1, wherein the expandable seal is adapted for sealing at least part of a wall of a tubing-lined borehole.

4. A seal as claimed in claim 1, further comprising at least one chamber adapted for inflation to urge the seal element radially outwardly.

5. A seal as claimed in claim 4, comprising a plurality of chambers.

6. A seal as claimed in claim 4, wherein the chamber is located radially inwardly of the seal element.

7. A seal as claimed in claim 4, wherein the chamber is annular and at least partially defined by the seal element and the support member.

8. A seal as claimed in claim 4, wherein the chamber is adapted to be initially isolated from annulus pressure and fluid in the borehole.
9. A seal as claimed in claim 1, wherein the seal element is expandable such that expansion of the support member also expands the seal element.
10. A seal as claimed in claim 1, further comprising a filler material adapted for maintaining the seal element in sealing engagement with the borehole.
11. A seal as claimed in claim 1, further comprising a chamber adapted for inflation to urge the seal element radially outwardly, the chamber containing a filler material adapted for maintaining the seal element under pressure in sealing engagement with the borehole.
12. A seal as claimed in claim 10, wherein the filler material is adapted to react with a selected reactant to solidify and maintain the chamber in an inflated condition.
13. A seal as claimed in claim 10, wherein the filler material comprises a granular solid material.
14. A seal as claimed in claim 1, wherein the seal element is adapted to be inflated by applied fluid pressure.
15. A seal as claimed in claim 14, comprising a reactant fluid for reacting with a filler material in the seal element to form a single, solid member for maintaining the seal element inflated.

16. A seal as claimed in claim 14, wherein the fluid comprises a reactant for reacting with a filler material in the seal element to form a viscous mass, for maintaining the seal element inflated.

17. A seal as claimed in claim 14, comprising a sealing member for controlling application of fluid pressure to the seal element and for maintaining inflation of the seal element.

18. A seal as claimed in claim 17, wherein the sealing member comprises a generally tubular valve member adapted to open when fluid pressure within the valve member is at least equal to the pressure of fluid outside the valve member and adapted to close when fluid pressure within the valve member is less than that outside the valve member.

19. A seal as claimed in claim 18, wherein the tubular valve member is collapsible to close the valve.

20. A seal as claimed in claim 14, comprising a sealing member coupled to the support member, the sealing member having a deformable portion movable between a closed position and an open position for controlling application of fluid pressure to the seal element.

21. A seal as claimed in claim 20, wherein the sealing member is expandable together with the support member.

22. A seal as claimed in claim 20, wherein the sealing member is movable between the closed and open positions in response to an applied fluid pressure force.

23. A seal as claimed in claim 20, wherein the sealing member is mounted externally of the support member and is of a material having a Young's modulus greater than that of the support member.

24. A seal as claimed in claim 20, wherein the sealing member is mounted internally of the support member and is of a material having a Young's modulus less than that of the support member.

25. A seal as claimed in claim 20, wherein the seal member is annular and is located at least partly in abutment with the support member.

26. A seal as claimed in claim 1, wherein the seal element is elastically deformable.

27. A seal as claimed in claim 1, wherein the seal element comprises an elastomeric material.

28. A seal as claimed in claim 1, wherein the support member includes at least one aperture for fluid communication between the seal element and the interior of the support member.

29. A seal as claimed in claim 28, wherein the support member includes a plurality of apertures.

30. A seal as claimed in claim 28, wherein the support member includes a plug for closing the aperture to initially prevent fluid communication between the seal element and the interior of the support member.

31. A seal as claimed in claim 30, wherein the aperture is openable by deformation of the plug.
32. A seal as claimed in claim 30, wherein the plug includes a hollow portion and an end cap for closing flow through the hollow portion, and wherein the end cap is removable to allow fluid communication through the hollow portion.
33. A seal as claimed in claim 31, wherein the plug is adapted to be crushed to open the aperture.
34. A seal as claimed in claim 30, wherein the plug is removable to allow fluid communication.
35. A seal as claimed in claim 34, wherein the plug is releasably engageable in the aperture and is adapted to disengage the aperture to allow fluid communication on expansion of the support member.
36. A seal as claimed in claim 28, comprising a sealing member for controlling application of fluid pressure to the seal element and for maintaining inflation of the seal element, the/each aperture including a respective sealing member.
37. A seal as claimed in claim 28, comprising a sealing member for controlling application of fluid pressure to the seal element and for maintaining inflation of the seal element, the sealing member adapted to seal a plurality of apertures.

38. A seal as claimed in claim 28, wherein the support member is at least partly perforated.

39. A seal as claimed in claim 38, wherein the support member at least partly comprises slotted tubing.

40. A seal as claimed in claim 1, further comprising a screen member provided between the seal element and the support member.

41. A seal as claimed in claim 40, wherein the seal further comprises a granular solid filler material adapted for maintaining the seal element in sealing engagement with the borehole, and wherein a pore size of the screen member is smaller than the average grain size of the granular material.

42. A seal as claimed in claim 1, further comprising at least one reinforcing member for reinforcing the seal element to support the seal element during expansion.

43. A seal as claimed in claim 42, wherein the seal includes a reinforcing member at each end of the seal element to contain inflation of the seal element.

44. A seal as claimed in claim 42, wherein the reinforcing member is integral with the seal element.

45. A seal as claimed in claim 42, wherein the reinforcing member is separate from the seal element.

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46. A seal as claimed in claim 1, comprising an expandable sandscreen located around the seal, the sandscreen adapted to be expanded by inflation of the inflatable seal element of the seal.

47. An expandable seal assembly for sealing at least part of a wall of a well borehole, the assembly comprising:

at least two expandable seals for sealing engagement with the wall of the well borehole, each expandable seal comprising an expandable tubular support member and an inflatable seal element mounted externally of the expandable tubular support member for inflation radially outwardly into sealing engagement with the well borehole wall.

48. An expandable seal assembly for sealing at least part of a wall of a well borehole, the assembly comprising:

first and second spaced expandable seals for sealing engagement with the wall of the well borehole at spaced locations, each expandable seal comprising an expandable tubular support member and an inflatable seal element mounted externally of the expandable tubular support member for inflation radially outwardly into sealing engagement with the well borehole wall.

49. An assembly as claimed in claim 48, further comprising an expandable tubular extending between the first and second spaced expandable seals.

50. An assembly as claimed in claim 49, wherein the expandable tubular comprises an expandable sandscreen.

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51. An assembly as claimed in claim 50, wherein the expandable sandscreen comprises an inner expandable support tubing, an outer expandable protective tubing and a filter screen sandwiched between the inner and outer tubing.

52. An assembly as claimed in claim 49, further comprising a solid tubular coupled to one of the first and second expandable seals.

53. An assembly as claimed in claim 49, further comprising a solid tubular coupled to both of the first and second expandable seals.

54. An assembly as claimed in claim 52, wherein the solid tubular is expandable.

55. An assembly as claimed in claim 49, wherein the expandable tubular comprises an at least partly perforated tubular.

56. An assembly as claimed in claim 48, comprising an expandable sandscreen located around the seals, the sandscreen adapted to be expanded in one or more location by inflation of the inflatable seal element of a selected one or more seal.

57. An assembly as claimed in claim 47, wherein the expandable seals each comprise an expandable seal as claimed in claim 2.

58. An expandable seal assembly for sealing at least part of a wall of a well borehole, the assembly comprising:

first and second spaced expandable seals for sealing engagement with the wall of the well borehole at spaced locations, each expandable seal comprising an expandable tubular support member and an inflatable seal element mounted



externally of the expandable tubular support member for inflation radially outwardly into sealing engagement with the well borehole wall; and

an expandable sandscreen extending between the first and second spaced expandable seals.

59. A method of sealing at least part of a well borehole, the method comprising the steps of:

locating an expandable seal in the well borehole;

expanding a tubular support member of the expandable seal; and

inflating a seal element mounted on the tubular support member radially outwardly into sealing engagement with the well borehole.

60. A method as claimed in claim 59, wherein the seal is located in an unlined borehole.

61. A method as claimed in claim 59, wherein the seal is located in a tubing-lined borehole.

62. A method as claimed in claim 59, wherein the support member is mechanically expanded.

63. A method as claimed in claim 62, wherein a tubing expansion tool is run through the seal to expand the tubular support member.

64. A method as claimed in claim 59, wherein the seal element is expanded when the support member is expanded.

65. A method as claimed in claim 59, further comprising maintaining the seal element in sealing engagement with the borehole.
66. A method as claimed in claim 59, wherein the seal element is inflated by supplying a fluid under pressure to the seal element.
67. A method as claimed in claim 66, wherein the fluid is supplied to a chamber between the support member and the seal element.
68. A method as claimed in claim 66, wherein the fluid is pressurised above a pore pressure of a rock formation in the region of the borehole adjacent the seal.
69. A method as claimed in claim 66, wherein the seal element is maintained inflated using a sealing member.
70. A method as claimed in claim 66, wherein the fluid reacts with a filler material in the seal to form a single solid mass maintaining the seal element inflated.
71. A method as claimed in claim 66, wherein the fluid reacts with a filler material in the seal to form a viscous mass maintaining the seal element inflated and under pressure.
72. A method as claimed in claim 59, further comprising coupling a plurality of expandable seals together to form a string of expandable seals, and locating the string of expandable seals in the well borehole before expanding the tubular support member and inflating the seal element of each expandable seal.

73. A method as claimed in claim 59, further comprising enlarging the borehole prior to location of the seal in the borehole.

74. A method as claimed in claim 73, comprising underreaming the borehole.

75. A method as claimed in claim 59, comprising providing an expandable sandscreen around the seal and expanding the sandscreen by inflating the seal element of the seal.

76. A method of sealing at least part of a well borehole, the method comprising the steps of:

coupling at least one expandable seal including a tubular support member and an inflatable seal element to an expandable tubular and locating the expandable tubular and expandable seal in the well borehole;

expanding the tubular support member of said expandable seal; and

inflating the seal element of said expandable seal radially outwardly into sealing engagement with the well borehole.

77. A method as claimed in claim 76, comprising coupling an expandable seal to opposite ends of the expandable tubular; expanding the tubular support members of said expandable seals; and inflating the seal elements of said expandable seals into sealing engagement with the well borehole.

78. A method as claimed in claim 76, further comprising expanding the expandable tubular.

79. A method as claimed in claim 76, comprising providing an expandable sandscreen around the seal and expanding the sandscreen by inflating the seal element of the seal.

80. A sealing apparatus for sealing at least one flow port in an expandable downhole tubular, the sealing apparatus comprising:

a sealing member coupled to the expandable tubular, the sealing member including a deformable portion movable between a closed position preventing fluid flow through the flow port and an open position permitting fluid flow through the flow port.

81. A sealing apparatus as claimed in claim 80, wherein the sealing member is adapted to be expanded on expansion of the expandable tubular.

82. A sealing apparatus as claimed in claim 80, wherein the deformable portion is normally urged towards the closed position.

83. A sealing apparatus as claimed in claim 80, wherein the deformable portion is plastically deformable.

84. A sealing apparatus as claimed in claim 80, wherein the deformable portion is movable between the closed and open positions in response to an applied fluid pressure force.

85. A sealing apparatus as claimed in claim 84, wherein the deformable portion is adapted to move to the open position in response to an applied fluid pressure force of a determined magnitude.

86. A sealing apparatus as claimed in claim 80, wherein the sealing member is mounted externally of the expandable tubular.

87. A sealing apparatus as claimed in claim 86, wherein the sealing member is secured to an outer surface of the tubular.

88. A sealing apparatus as claimed in claim 86, wherein the sealing member is of a material having a higher Young's modulus than the expandable tubular.

89. A sealing apparatus as claimed in claim 80, wherein the sealing member is mounted internally of the expandable tubular.

90. A sealing apparatus as claimed in claim 89, wherein the sealing member is secured to an internal surface of the tubular.

91. A sealing apparatus as claimed in claim 89, wherein the sealing member is of a material having a lower Young's modulus than the expandable tubular.

92. A sealing apparatus as claimed in claim 80, wherein the sealing member is annular and has an end adapted to be secured to the expandable tubular.

93. A sealing apparatus as claimed in claim 92, wherein the other end of the sealing member engages the expandable tubular in an interference fit.

94. A sealing apparatus as claimed in claim 80, wherein the sealing member is adapted for sealing a plurality of flow ports spaced around a circumference of the expandable tubular.

95. A sealing apparatus as claimed in claim 80, wherein the sealing member is adapted for sealing a plurality of flow ports spaced along a length of the expandable tubular.

96. A sealing apparatus as claimed in claim 95, wherein the sealing member is a sleeve.

97. A sealing apparatus as claimed in claim 80, wherein the sealing apparatus has a utility for sealing a flow port in an expandable support tube of a seal as claimed in claim 1.